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IS 7599-1 (1975): General requirements for engineer's comparators with stands, Part I: engineer's comparators [PGD 25: Engineering Metrology]

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Indian Standard

GENERAL REQUIREMENTS FOR ENGINEER'S COMPARATORS WITH STAND

PART I ENGINEER'S COMPARATORS

Engineering Metrology Sectional Committee, EDC 43; Gauges Subcommittee, EDC 43 : 3 [Ref : Doc : EDC 43 (2276) F_1]

1. Scope — Covers the requirements of engineer's comparators used for external measurement having magnification factors of 250 and over. The requirements of the comparator stand are covered in Part II of this standard.

2. General Requirements

2.1 *Measuring Contact*

2.1.1 The measuring contact shall be of hardened steel having a hardness of 850 *HV, Min* (65 *HRC* approximately) [*see* IS : 1501-1968 Method for Vickers hardness test for steel (*first revision*)] or of alternative material of comparable wearing properties.

2.1.2 The face of the measuring contact shall normally be rounded (a minimum radius of 8 mm is recommended).

2.1.3 If a flat face is required, means shall be provided whereby the user is able to adjust the face of the contact so that the required degree of parallelism can be obtained between the measuring contact and the surface of the work-table.

2.1.4 The measuring contact may be provided with a raising device.

2.1.5 The force applied to the measuring contact to obtain zero reading on the instrument shall be in the order of 2·0 to 2·5N.

2.1.6 The operating force shall be substantially constant throughout the working range and in no case shall the maximum force be more than 50 percent greater than the minimum, for instruments having magnification factor below 5 000 and not more than 15 percent greater than the minimum for instruments having magnification factor greater than 5 000.

2.2 *Pointer*

2.2.1 In dial reading instruments, the pointer shall be rigidly attached to its spindle in such a manner as to ensure that there will be no relative movement between them when the measuring contact is subject to rapid acceleration or deceleration, as in the event of the measuring contact being suddenly released and its motion arrested by a fixed stop. The pointer should be provided with a suitable damping device.

2.2.2 The thickness of the pointer shouid be the same as or less than that of the scale marks. The design of the pointer and associated scale shall be such as to reduce to the lowest possible value any errors due to parallax. For instruments having pointers which pass over the scale, the pointer tip should overlap the scale marks by one-fifth to one-half of the length of the shortest scale marks.

2.3 *Scale*

2.3.1 The scale shall consist of black scale marks (*see* Fig. 1) on a white back ground, or such other combination of contrasting colours as will show up with equal clarity, so that it can be conveniently read under ordinary good workshop lighting conditions.

2.3.2 All scale marks shall have a clean sharp outline and be uniform in thickness. Line thickness should be not greater than one-fifth of the distance separating two scale intervals (*see* Fig. 1).

2.3.3 Both fifth and tenth scale intervals shall be extended. On single range scales at least every tenth interval shall be numbered, and the value of each scale interval clearly marked within the scale area, or be numbered at least every tenth interval and the half scale value be clearly marked at plus and minus ends of the scale. On multi-range scales at least each tenth interval shall be numbered and the value of each scale interval clearly marked within the scale area using a suitable code to identify scale and scale interval value. Fine sub-division of the scale is to be avoided. It is recommended that no two scale marks should be closer than 1 mm.

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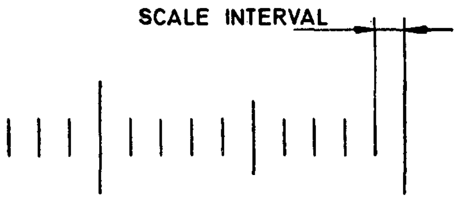

FIG. 1 SCALE

2.3.4 The zero scale mark should preferably be at the centre of the scale. Scales requiring the zero position to be other than in the centre position shall be the subject of agreement between the purchaser and the manufacturer of the instrument. The relative movement of the pointer and scale should be such as to suggest to the observer the direction of movement of the measuring contact as the work is passed under it. For example, where the pointer moves over a fixed scale, an increase in the size of the work should be indicated by a movement of the pointer upwards (on a vertical scale) or to the right (on a horizontal scale). If the scale is in the form of arc above the centre of rotation of the pointer, a clockwise movement of the pointer should indicate an increase in work size. Where the scale is in the form of an arc below the centre of rotation of the pointer, an anticlockwise movement of the pointer should indicate an increase in work size.

2.3.5 The scale shall be boldly marked with plus and minus signs to indicate increase and decrease in the size of the measured work.

3. Tests

3.1 *Accuracy of Scale* — The accuracy of the scale of the instrument shall be tested by making readings on a suitable series of calibrated slip gauges, first over the positive half of the scale and then over the negative half of the scale, checking at each major division. No reading shall have an error exceeding one percent of the reading (plus or minus) or the appropriate amount (plus or minus) given in col 2, Table 1, whichever is greater.

3.2 *Consistency of Reading* — The consistency of reading of the comparator shall be examined by carrying out the following series of tests, the permissible errors being related to the magnification factor.

3.2.1 When the instrument has been set to read on a workpiece and measuring head gently tapped the maximum change in reading shall not exceed one-half of the appropriate amount given in col 2, Table 1.

3.2.2 When a true cylinder is passed under the measuring anvil (cylinder shall not be rolled under the measuring anvil) :

from the front

from the rear

from the left-hand side

from the right-hand side

Maximum difference in reading found shall not exceed one-half of the values in col 2, Table 1.

3.2.3 The readings obtained when sliding a slip gauge under the contact shall not differ from subsequent readings obtained by operating the trigger device, by more than the appropriate amount given in col 2, Table 1.

4. Packing — The comparators shall be packed according to the best trade practice prevalent in the country.

5. Marking — Each instrument shall be marked with the maker's name or recognized trade-mark, and with a serial number.

5.1 *ISI Certification Marking* — Details available with the Indian Standards Institution.

TABLE 1 TOLERANCE ON SCALE READING

(*Clauses* 3.1, 3.2.1, 3.2.2 *and* 3.2.3)

Magnification Factor* of Measuring Head (1)	Minimum Tolerance of Reading (2) mm
From 250 up to and including 500	0·001 5
Above 500 up to and including 1 000	0·000 8
,, 1 000 ,, ,, ,, ,, 2 000	0·000 5
,, 2 000 ,, ,, ,, ,, 5 000	0·000 3
,, 5 000 ,, ,, ,, ,, 10 000	0·000 1
,, 10 000 and above	0·000 03

Note — In the case of a comparator fitted with optical or electrical means of amplification, precautions should be taken in the design to ensure that neither the zero setting nor the calibration of the instrument is disturbed by any heating effects arising from its lamp or electric coils or from any fluctuations of voltage or frequency in the electric supply.

* The magnification factor is obtained by dividing the distance between the two graduation marks on the scale by the equivalent displacement of the measuring contact, for example, if the distance between the marks is 0·9 mm, and the corresponding displacement of the measuring contact is 0·001 mm, the magnification factor is 900.

EXPLANATORY NOTE

These instruments are known by the general name of comparators since they serve for measuring workpieces by comparing their sizes with slip gauges or other standard gauges of closely the same size, the comparison being made by inserting the standard gauge and the workpiece under the measuring contact in turn and noting the difference between their sizes on the scale of the measuring head.

The standard is intended to relate primarily to comparators of the vertical type, but may be adopted for horizontal types in so far as the requirements are applicable.

This standard does not apply to comparators with measuring heads having a magnification of less than 250 or to comparators fitted with mechanically operated measuring heads of the dial indicator type in which the indicating pointer turns through several complete revolutions. Such dial indicators are dealt with IS : 2092-1962 ' Dial gauges '.

In the preparation of this standard assistance has been derived from BS : 1054-1954 " Engineer's comparators for external measurement " and draft BS : 73/33653 " Engineer's mechanical comparators for external measurement " issued by the British Standards Institution.

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